On parasitic gaps in relative clauses and the nature of extraction from nominal phrases[*]

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1   Introduction

In this paper, I contribute to a line of research using parasitic gaps (PGs; Engdahl 1983) to investigate the properties of A′-movement (Nissenbaum 2000; Legate 2003; Overfelt 2015b; Erlewine and Kotek 2018; Bondarenko and Davis 2019; Davis 2020b, a.o.). In particular this paper focuses on the hypothesis, supported by a great deal of recent research, that movement paths are often comprised of several successive-cyclic steps:

(1)   *A schema for a successive-cyclic movement path*
$[_{XP}\ \alpha\ \text{X}\ ...\ [_{YP}\ t\ \text{Y}\ ...\ [_{ZP}\ t\ \text{Z}\ ...\ t\ ]$

See Chomsky 1973, 1977, 1986; Du Plessis 1977; Henry 1995; Cole and Hermon 2000; McCloskey 2000, 2001, 2002; Nissenbaum 2000; Legate 2003; Sauerland 2003; Bruening 2001, 2006; Barbiers 2002; Torrence 2012; Abels 2003, 2012; Wiland 2010; Henry 2012; van Urk 2015; van Urk and Richards 2015; Korsah and Murphy 2019; Davis 2019, 2020a,b, and many others, for arguments for the successive-cyclicity of movement. Many of these works argue that movement must be successive-cyclic specifically when exiting a *phase* (Chomsky 2000, 2001, a.o.), pausing in the phase edge before continuing on, as illustrated in (2) below. The set of phases is generally taken to be vP, CP, and sometimes DP. Phase theory is in essence an updated version of the older hypothesis that syntactic derivations involve discrete cycles, which break up syntactic dependencies like movement into cycle-by-cycle transformations. The details of phase theory are not important for this paper, though see Citko (2014) for a recent overview. Rather, phase theory is only relevant here to the extent that discussions about phases bear on more general questions about when syntactic operations are successive-cyclic or not.

(2)   *Successive-cyclic movement through phase edges (here vP and CP)*
What did you say $[_{CP[Phase]}$ t that$_C$ you$_S$ will$_T$ $[_{vP[Phase]}$ t eat$_{v-V}$ t]]]?

A growing body of recent research argues that there is a nominal phase below D. Some of the evidence for this proposal comes from morpho-phonology. Several works in this domain argue that lexical projections like NP, VP, and AP consist of a category-neutral root and a phasal categorizing head (Marvin 2003; Newell 2008; Embick and Marantz 2008;

Embick 2010; Newell and Piggott 2014, a.o.), such as *n*, *v*, or *a*. For such works NP is, in fact, the phasal *n*P. Additionally, Bayırlı (2017) argues that the phasehood of NP (in certain languages) constrains the distribution of concord. Other work comes to a similar conclusion from purely syntactic considerations. For instance, Syed (2015); Simpson and Syed (2016); Syed and Simpson (2017) argue for the presence of a DP-internal phase in Bangla, while Simpson and Park (2019) argue for a phasal *n*P in Korean. Importantly for this paper, if a sub-constituent of DP like NP (or whatever equivalent label) is indeed a phase, then we expect movement from it to pass successive-cyclically through its edge:[1]

(3)   *General prediction: Successive-cyclic movement via edge of NP*
        Who did you take [$_{DP}$ a [$_{NP}$ $\boxed{t}$ [$_{N'}$ picture of t]]]?

In this paper, I argue that the possibility of such movement is revealed by PGs in relative clauses licensed by extraction from NP—a phenomenon that has received little attention:[2]
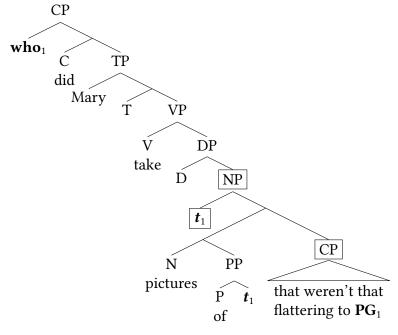
(4)   *PG in relative clause licensed by extraction from the same NP*

   a.   Who$_1$ did Mary take [[pictures of t_1]$_2$ [that __$_2$ weren't that flattering to **PG**$_1$]]? (Citko 2014, ex. 105)

   b.   Mary is very picky about art. [This kind of person]$_1$, I could never paint [[an image of t_1]$_2$ [that __$_2$ would be able to satisfy **PG**$_1$ even a little]].

   c.   Let me tell you [which cafe]$_1$ I learned [[something about t_1]$_2$ [that __$_2$ really makes me want to avoid **PG**$_1$]] [as I was watching the news today].

   d.   That's the guy who$_1$ I know [[an employee of t_1]$_2$ [who's __$_2$ had a very intense grudge against **PG**$_1$ since last year]].

   e.   I just got a kitten ∅$_1$ that I'm gonna go buy [[a toy for t_1]$_2$ [that __$_2$ I think will be likely to entertain **PG**$_1$]].

   f.   Mary is the one who$_1$ I painted [a silly portrait of t_1]$_2$ [that John likes to give copies of __$_2$ to friends of **PG**$_1$ at every chance he gets].

The core proposal of this paper, which I explore several implications of, is as follows. If (restrictive) relative clauses are adjoined to NP, below determiners/quantifiers (Quine 1960; Stockwell et al. 1973; Partee 1975; Heim and Kratzer 1998, a.o.) and if the interpretation of a PG is dependent on movement through the edge of the phrase to which the PG-container adjoins (Nissenbaum 2000; Legate 2003; Davis 2020b), then the possibility of PGs in relative clauses reveals the availability of a landing site in the NP edge:

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[1]See Manlove (2016) and references therein for other relevant discussion.

[2]Aside from Citko (2014) (discussed below), the only other work I know to have mentioned such examples is Matushansky (2005), who reports that they are ungrammatical. So far, 12/16 individuals who have provided me with their judgments accept this PG configuration (plus several anonymous conference reviewers). As Engdahl (1983) notes, there is considerable inter-speaker variation on the acceptability of PGs, so I will not dwell on the fact that not all speakers accept these relative clause examples. Rather, I will focus on the general implications of the fact that many speakers do accept them. Given that these examples are multi-gap configurations, they will necessarily be somewhat marked due to their high processing burden.

(5) *PG-bearing relative clause adjoined to NP (based on (4a) above)*

```
              CP
      who₁
            C      TP
            did
               Mary
                  T      VP
                       V      DP
                       take
                            D    [NP]
                                [t₁]
                               N      PP        [CP]
                            pictures
                                    P   t₁   that weren't that
                                    of        flattering to PG₁
```

In principle movement via the DP edge as well is not precluded, as I discuss later on. Further, the PG facts I examine here do not reveal the necessity of movement via the NP edge, which we expect if NP is a phase, but rather just its possibility.[3] Nevertheless, I argue that this result has a number of interesting consequences about the nature and distribution of movement from nominal constituents.

1.1 Contents of the paper

Section 2 provides background on PGs, and their connection to intermediate landing sites of movement. Section 3 provides further empirical background on the variety of PG I focus on here. Section 4 discusses in greater detail the nature and significance of relative clauses. Section 5 provides a syntactic and semantic analysis of the facts, which vitally relies on the proposal that successive-cyclic movement through the NP edge is available. Section 6 analyzes a further fact about PGs in stacked relative clauses. Section 7 provides additional empirical evidence for successive-cyclic movement from NP from facts about binding. Section 8 addresses the consequences of these results for theories about extraction from NP, focusing on the role of locality, and section 9 concludes.

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[3]It is worth noting that the NP edge is not available as a final landing site for any movement process in English. (This contrasts with the DP-internal movements that Simpson and Syed (2016) and Syed and Simpson (2017) examine in Bangla, for instance.) This fact indicates that, if there is indeed movement through the NP edge in English as I argue, this cannot simply be the result of further movement after the application of some independent movement process into that position. Such movement must either be forced by some more general factor (such as phase theory, or any comparable theory of cyclic domains and the locality of movement), or alternatively we might posit that movement through intermediate positions can occur freely without any direct motivation, as long as independent locality constraints don't interfere.

2 Background: PGs and intermediate landing sites

A PG is a gap whose interpretation depends on A′-movement external to, and structurally crossing, the containing constituent (Engdahl 1983; Culicover and Postal 2001). That a given gap is indeed "parasitic" is clearest when in an island, since this shows that the PG was not formed by straightforward extraction. PGs in sentential adjuncts, such as those in (6) are frequently reported in the literature.

(6) *PGs in sentential adjunct*
     Who$_1$ did you forget about t_1 $\big[$ $\big[$ after talking to **PG**$_1$ $\big]$ $\big]$?

In this section I will overview the syntax and semantics of PGs in sentential adjuncts (chiefly following Nissenbaum 2000), since the concepts involved with them will serve as a convenient basis for examining PGs in relative clauses later on in the paper.

A well-known property of PGs is that they can be separated from their antecedent phrase by an island, unlike gaps of the more usual variety. Here I will follow previous works arguing that this is so because a PG is not formed by movement from an island, but rather, of a separate silent operator within the island (Contreras 1984; Stowell 1985; Chomsky 1986; Browning 1987; Nissenbaum 2000; Nissenbaum and Schwarz 2011, a.o.):[4]

(7) *PG as trace of null operator*
     Who$_1$ did you forget about t_1 $\big[$ $\big[$$_{AdjunctP}$ **OP** after talking to $t_{\mathbf{OP}}$(=**PG**) $\big]$ $\big]$?

Under this analysis PGs present no locality puzzle, since they involve island-internal movement rather than island-crossing movement. Shortly I will address some other correct syntactic predictions of this proposal and relate them to the core relative clause facts. Before that, however, here I will discuss the syntax/semantics for PGs in Nissenbaum (2000), who both provides a motivation for the operator movement and establishes a connection between the possibility of PGs and the successive-cyclicity of movement.

As mentioned above, much work argues that movement is successive-cyclic when it exits a phase, and thus forms intermediate landing sites in phase edges:
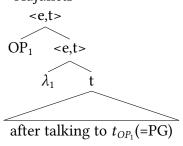
(8) *Successive-cyclic movement from vP and CP*
     What did you say $[_{CP_{[Phase]}}$ t that$_C$ you$_S$ will$_T$ $[_{vP_{[Phase]}}$ t eat$_{v-V}$ t]]]?

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[4]The null operator approach to PGs is in contrast to "shared antecedent" theories, for which PGs involve genuine extraction of a variety resembling the Across-The-Board (ATB) movement from a coordinate structure. As Nissenbaum (2000) and Nissenbaum and Schwarz (2011) discuss, asymmetries in reconstruction for principle A, principle C, and variable binding all show that PGs involve a separate operator, and are thus not reducible to ATB configurations. See Engdahl (1983) and Munn (2001) for other evidence that PGs are not reducible to ATB configurations (though Munn argues that ATB configurations are sometimes essentially PG structures, rather than the other way around). Additionally, it has been observed that at least in English PGs must be nominal phrases (Postal 1994; Culicover and Postal 2001), whereas a similar restriction does not apply to ATB gaps. Thus there are a wide variety of reasons for maintaining that ATB gaps and PGs are distinct, in addition to the independent empirical evidence that PGs are null operator structures.

Importantly, Nissenbaum (2000) argues many PGs are facilitated by the relevant operator-hosting phrase adjoining to an intermediate landing site formed by successive-cyclic movement. In particular, he argues that the intermediate landing site formed by movement from vP facilitates PGs in sentential adjuncts of the form in (6-7) above.
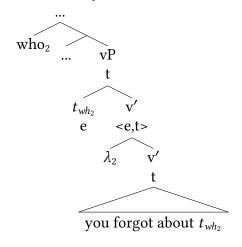
The account in Nissenbaum (2000) (further explored by Nissenbaum and Schwarz 2011) is as follows. The PG-forming operator moves to the edge of the containing island, triggering the semantic rule Predicate Abstraction (Heim and Kratzer 1998). In the case of a sentential adjunct island, its original type t is thus raised to <e,t> (assuming semantic vacuity of the operator), and therefore becomes a semantic predicate with an open argument position whose eventual saturation will result in binding of the PG:[5]

(9)   *Null operator movement inside adjunct forms a clausal predicate*
        AdjunctP
        <e,t>

        OP$_1$ <e,t>

              λ_1 t

        after talking to t_{OP_1}(=PG)

In addition to this island-internal operator movement, the licensing phrase that ultimately binds the PG successive-cyclically moves through vP. This triggers an application of Predicate Abstraction in vP, creating an <e,t> position here as well, though in this case that function is immediately saturated by the trace of successive-cyclic movement from vP:
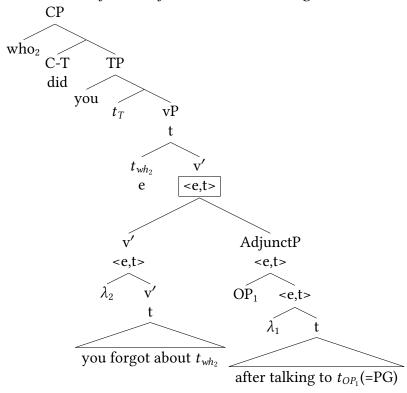
(10)   *Successive-cyclic A′-movement creates an <e,t> node in vP*

                ...

        who$_2$

                ...   vP
                        t

              t_{wh_2} v′
              e   <e,t>

                    λ_2 v′
                              t

              you forgot about t_{wh_2}

---

[5]Heim & Kratzer implement Predicate Abstraction by inserting a syntactic node bearing an index co-referent with the variable that corresponds to the gap left behind by the moved phrase, and assuming that this structure is converted into the appropriate λ-term at LF. For the sake of simplicity I diagram the nodes inserted by Predicate Abstraction as containing a λ bearing the relevant index.

The type <e,t> operator-containing adjunct derived in (9) can be adjoined to the <e,t> node created by successive-cyclic movement from vP in (10), and semantically combined with it by the operation Predicate Modification (Heim and Kratzer 1998). This results in the boxed <e,t> node in (11) below, which denotes the set of individuals x such that the addressee forgot about x after talking to x. This function is saturated by the intermediate type e trace of successive-cyclic A′-movement from vP. As a result, the A′-moved phrase which left that trace ultimately comes to bind its original trace in the VP, and the trace of the moved operator in the adjunct, which is the PG.[6]

(11)   *Predicate Modification of vP with PG-containing island*

Under this account, movement of a semantically vacuous operator within the island is necessary to make it a predicate, whose saturation results in "parasitic" binding of the gap in the island. Importantly, that island must combine with a position created by successive-cyclic movement of the PG-licensing phrase, since by virtue of Predicate Abstraction such

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[6]Here I adopt from Nissenbaum the simplifying assumption that vPs and vP modifiers (like sentential adjuncts) are type t, modulo A′-movement within them triggering Predicate Abstraction. As Nissenbaum notes, this is a simplification because it ignores the presence of temporal and event arguments, but enriching the semantic type of these constituents does not make any important difference for the account of PGs. In particular, given a more general version of the rule of Predicate Modification that allows constituents of the same semantic type to be combined, the account described here functions the same whether the type of vPs and their adjuncts is t, or something more complex. Such a flexible version of Predicate Modification is independently required by Nissenbaum 2000 and Nissenbaum and Schwarz (2011), with precedent in Partee and Rooth (1983), and will be necessary for the analysis of PGs in relative clauses as well.

a position is a predicate that will be saturated by (a trace of) that licensing phrase. Significantly, this syntax/semantics for PGs makes a more general prediction:

(12) *Prediction about PGs and landing sites of movement*
      If a PG-containing phrase can be interpreted when adjoined to a given position, that position must be a possible (intermediate) landing site for movement.

Legate (2003) uses this reasoning to argue for successive-cyclic movement in various verbal constituents. I will use this reasoning to show how PGs in relative clauses indicate the possibility of movement via the edge of NP. Before that, however, in the next two sections I discuss some additional empirical considerations about PGs in relative clauses, as well as relative clauses more generally, which will set the stage for the coming analysis.

3   More empirical background on PGs in relative clauses

It is a defining characteristic of PGs that they are illicit in the absence of a licensing A′-movement, upon which their interpretation is "parasitic":

(13) *Usual PGs require a licensing movement*
      a.   Who$_1$ did you forget about t_1 [after talking to PG$_1$]?
      b.   * I forgot about John$_1$ [after talking to PG$_1$].
      c.   This is a dish [$\varnothing_2$ that I know a lot about t_2 [because I make PG$_2$ every week]].
      d.   * I know a lot about [fried chicken]$_2$ [because I make PG$_2$ every week].

The same holds for PGs in relative clauses:

(14) *Extraction from NP required for PG in relative clause*
      a.   I painted [a portrait of Mary$_1$ [that unfortunately didn't please **her**$_1$/***PG**$_1$]].
      b.   I've noticed [an aspect of John$_2$ [that makes me want to avoid **him**$_2$/***PG**$_2$]].
      c.   Mary took [pictures of [a person]$_3$ [that weren't that flattering to **them**$_3$/***PG**$_3$]].

Previous literature has observed that separating a PG-containing island from the licensing movement chain by a larger island is generally illicit (Kayne 1983; Chomsky 1986; Cinque 1990; Postal 1994):

(15) *PG licensing across multiple islands degraded*
      a.   *Relative clause island plus adjunct island*
           * Tell me who$_1$ you talked to t_1 [after meeting a person [who likes PG$_1$]].
      b.   *Subject island plus adjunct island*
           * Durian is a fruit [which$_1$ I tried t_1 for the first time [after [every variety of PG$_1$] was sent to me by someone who really likes them]].
      c.   *Adjunct island in adjunct island*
           * Guess who$_1$ I ironically ran into t_1 [after taking the other hallway [because I wanted to avoid PG$_1$]].

This fact emerges automatically from the null operator theory of PGs, since operator movement should be island-bounded just like other forms of movement. In order for a PG to be interpreted, the corresponding operator must move to the edge of the containing island structure in order to turn it into a predicate via Predicate Abstraction, as described above. If the PG is only contained in one island, nothing prevents such movement:

(16) *Operator movement to edge of containing island*
Who$_1$ did you forget about t_1 [OP after talking to t_{OP}(=PG)]?

However, if the PG is embedded in two islands, the operator must move out of the smaller island to reach the edge of the larger one, in order to apply Predicate Abstraction to it. Since this movement would have to cross the lower island, it is accurately expected to fail:

(17) *PG-forming operator cannot cross an island to reach edge of larger island*
* Who$_1$ did you insult t_1 [OP after meeting a guy [who likes t_{OP}(=PG)]]?

As expected, an additional island separating a PG-containing relative clause from the PG-licenser results in degradation:

(18) *Additional island degrades PG-licensing in the relative clause*
   a. *Relative clause island*
      * Who$_1$ did Mary take [pictures of t_1 [$\varnothing_{REL}$ that t_{REL} were hilarious to everyone **[who has met PG$_1$ before]**]]?
   b. *Subject island*
      * That's the manager which$_2$ I know [an employee of t_2 [who$_{REL}$ thinks t_{REL} that **[every message from PG$_2$]** causes a problem]]].
   c. *Complex NP island*
      * [This person]$_4$, I painted [a portrait of t_4 [$\varnothing_{REL}$ that t_{REL} unfortunately started **[a rumor that I dislike PG$_4$]**]].

Furthermore, previous literature has observed that a PG in an embedded island is possible when the larger island also contains a co-referent PG (Kayne 1983; Longobardi 1984):

(19) *PG in embedded island licensed by PG in larger island*
   a. a person who$_1$ I hang out with t_1 [because [friends of PG$_1$] admire PG$_1$] (Nissenbaum 2000, p. 26, ex. 13c)
   b. Guess [which food]$_1$ I eat t_1 constantly [despite really fearing PG$_1$ [because there are carcinogens in PG$_1$]].

As Nissenbaum (2000) shows, this pattern can be understood as A′-movement of the operator in the larger island crossing over, and thus licensing a second PG in, the embedded island. Below we see such an example involving a PG-forming operator in an adjunct licensing a PG in that adjunct's subject:

(20) *PG-forming operator cannot cross an island to reach edge of larger island*
a person who$_3$ I like t_3 [OP$_1$ because [OP$_2$ friends of t_2] admire t_1]

Analogously, a PG in a relative clause licensed by extraction from NP can itself license a PG in an additional island embedded in the relative clause:
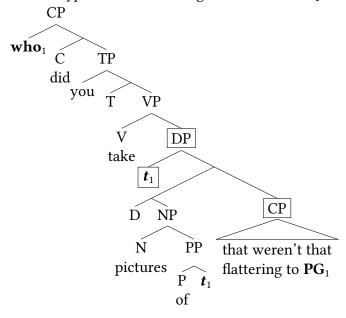
(21) *PG in relative clause can license an additional embedded PG*
   a. *Additional PG in sentential adjunct*
       Who$_1$ did Mary take [pictures of t_1 [$\varnothing_{\text{REL}}$ that t_{REL} weren't very flattering to **PG$_1$** [because she put an awful wig on **PG$_1$**]]]?
   b. *Additional PG in subject*
       That's the manager which$_2$ I know [an employee of t_2 [who$_{\text{REL}}$ t_{REL} thinks that [every message from **PG$_2$**] reveals the stupidity of **PG$_2$**]]].

To conclude this section, PGs T in relative clauses formed by extraction from NP behave as expected of PGs in general. I will therefore proceed in analyzing them as such. Before proceeding to the core analysis, however, the next section provides some relevant background information about the distribution of relative clauses.

4   The position and significance of relative clauses

Citko (2014) notes the existence of PGs in relative clauses, and suggests that this may constitute evidence for successive cyclic movement from DP, given a general prediction about PGs like that stated in (12) above. As Citko describes, this analysis entails that the relative clause can be merged in the projection of D, as shown below:
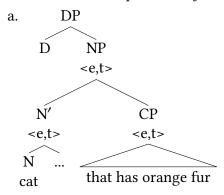
(22) *Citko's hypothesis: PG-bearing relative clause adjoined in DP*

9

A number of recent works take DP to be a phase, and thus another domain which move-ment from must be successive-cyclic (Heck and Zimmermann 2004; Bošković 2005, 2014, 2016; Newell 2008; Syed and Simpson 2017; Simpson and Park 2019, a.o.). If relative clauses could be merged to DP, the possibility of PGs in relative clauses could be taken as evidence for successive-cyclic movement from DP, given the general prediction

However, much work has argued that (restrictive)[7] relative clauses are adjective-like predicates that attach to NP, below any determiners or quantifiers (Quine 1960; Stockwell et al. 1973; Partee 1975, a.o.). Thus following Heim and Kratzer (1998), I assume that both NPs and relative clauses are predicates of individuals <e,t>, which combine via Predicate Modification, as the partial diagram below shows:

(23)   *Structure and interpretation of an NP with a restrictive relative clause*
         a.

         b. $\{x \mid x \text{ is cat}\}_{[[N']]} \cap \{x \mid x \text{ has orange fur}\}_{[[CP]]}$
                $= \{x \mid x \text{ is cat and } x \text{ has orange fur}\}_{[[NP]]}$

Several pieces of syntactic evidence support this proposal. For instance, NP-ellipsis can include relative clauses, but leave the rest of the DP behind:

(24)   *Relative clause and NP ellipsis*
         I brought four cakes to the party. Mary liked [two [cakes [that I brought]]], but Bill liked [all four ~~[cakes [that I brought]]~~]!

Relative clauses can also be included in a segment of NP that is subjected to *one*-replacement:

(25)   *Relative clauses and "one"-replacement* (Bhatt 2015, 32a)
         Bill admires the very tall [**student who came to Tom's lecture today**]. Antony admires the very short **one**.
         (*one* substitutes for '[$_{N'}$ [student] [who came to Tom's lecture today]]')

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[7] Much work in this vein also proposes that non-restrictive relative clauses, by contrast, may indeed ad-join to (what we would consider in contemporary terms to be) DP rather than NP. Because non-restrictive or "appositive" relative clauses are most suited to modifying proper names and definite descriptions, both of which are islands for extraction, the PG-licensing facts I am concerned with here cannot be straightfor-wardly tested for non-restrictive relatives.
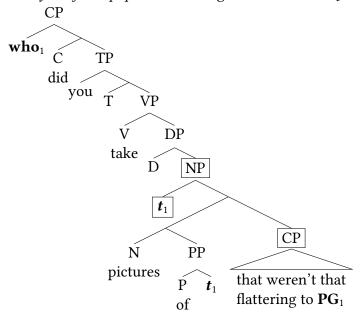
Additionally, he quantificational determiner *every* c-commands and thus can license NPIs like *ever* and *any* in a relative clause of the same nominal, but not within the containing clause, which it does not c-command (Ladusaw 1979; Overfelt 2015a, a.o.):

(26) *NPI licensing by "every"*

    a. [$_{DP}$ **Every** [$_{NP}$ guest [who ate **any** of the potato salad]] became ill.

    b. * [$_{DP}$ **Every** [$_{NP}$ guest [who became ill]] ate **any** of the potato salad. (Overfelt 2015a, ex. 10)

    c. [$_{DP}$ **Every** [$_{NP}$ student [who has **ever** chosen to study syntax]] loves *wh*-movement.

    d. * [$_{DP}$ **Every** [$_{NP}$ student [who loves *wh*-movement]] has **ever** chosen to study syntax.

These facts are all consistent with the proposal that relative clauses are adjoined below D, in NP. See Bhatt (2015) and Donati and Cecchetto (2011) for further evidence.

    Importantly, if (restrictive) relative clauses are merged in NP, then PG-licensing in a relative clause by extraction from NP actually indicates the possibility of successive cyclic A′-movement through the NP edge:

(27) *Analysis of this paper: PG-bearing relative clause adjoin to NP*

This is the analysis I adopt here, which is consistent with the works mentioned above arguing that a sub-DP constituent like NP is a phase. I argue that the possibility of movement via the NP edge has several interesting results, which I address after analyzing the derivation of PGs in relative clauses in greater detail in the next section.
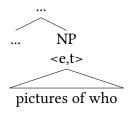
5 The derivation of PGs in relative clauses

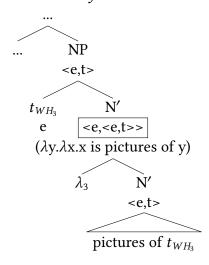Here I will provide the derivation for the following representative sentence:

(28)   *The example about to be derived* (Citko (2014), ex. 105)
       Who$_1$ did Mary take [pictures of t_1 [that weren't that flattering to **PG**$_1$]]?[8]

In the basic case NPs denote predicates from individuals to truth values <e,t>, as mentioned above, and as shown in (29a). When successive-cyclic movement through the NP edge occurs, such movement will apply Predicate Abstraction in the NP, adding a λe to its denotation, and creating a two place predicate <e,<e,t>> in the NP, as in (29b):

(29)   a.   *NP before sub-extraction*

```
          ...
         /  \
      ...    NP
             <e,t>
            /    \
        pictures of who
```

       b.   *Successive-cyclic movement and Predicate Abstraction in NP*

```
              ...
             /  \
          ...    NP
                 <e,t>
                /     \
           t_{WH₃}      N′
             e      <e,<e,t>>
               (λy.λx.x is pictures of y)
                      /    \
                    λ₃      N′
                            <e,t>
                           /     \
                   pictures of t_{WH₃}
```

The first λe of this two place predicate will be immediately saturated by the type e trace that successive-cyclic movement from the NP formed, as (29b) shows. This restores the type <e,t> status of the NP, which is then fit to combine with a determiner or quantifier as usual. Importantly, the intermediate <e,<e,t>> position in the NP facilitates the interpretation of a PG in a relative clause. Before showing explicitly why this is the case, however,

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[8]This example uses the relational noun *picture (of)*. For convenience I do not elaborate here on the internal semantic composition of such noun phrases, since regardless of how this occurs, these must end up with an <e,t> denotation like *λx.x is picture of John*. If this were not the case, such noun phrases would not be the right type to undergo adjunction of adjectives and relative clauses, or to undergo Functional Application with D/Q.

it is necessary to address the construction of the PG-containing relative clause.

I assume that both the gap of relativization and the PG in the relative clause are formed by movement of an operator (see footnote 11 for more on analyses of relativization). Prior to such movement, the relative clause in the relevant sentence has the following form:
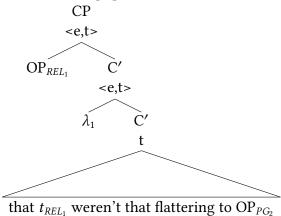
(30) *PG-containing relative clause, before operator movements*

```
            ...
          /    \
        ...     CP
                t
              /    \
            /        \
          /            \
that OP_REL₁ weren't that flattering to OP_PG₂
```

that OP_{REL_1} weren't that flattering to OP_{PG_2}

The correct interpretation emerges from these operators forming crossing paths, with the higher one moving first, and the lower one "tucking-in" (Richards 1997, 1999) to a position below it in the clause edge. Thus I will assume that first the relativizing operator moves to the edge of this CP, consequently applying Predicate Abstraction to its sister node. Assuming semantic vacuity of the operator, the CP is thus type <e,t>:

(31) *Relativizing operator movement*

```
                CP
               <e,t>
              /    \
         OP_REL₁    C′
                   <e,t>
                  /    \
                 λ₁     C′
                        t
                      /    \
                    /        \
that t_REL₁ weren't that flattering to OP_PG₂
```

OP_{REL_1} ... λ_1 ... that t_{REL_1} weren't that flattering to OP_{PG_2}
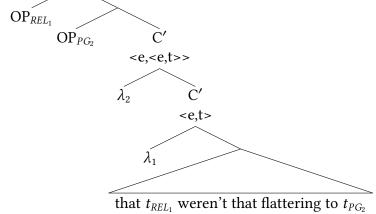
If the derivation ended here, this would be a basic relative clause, aside from the yet un-moved PG-forming operator. Next the PG-forming operator moves, tucking-in below the relativizing operator and triggering a second instance of Predicate Abstraction. This makes the relative clause type <e,<e,t>>, as (32) shows:[9] Following Heim and Kratzer (1998) I assume that when a phrase's movement triggers Predicate Abstraction, it inserts a λe on top of the sister of the landing site of that moved phrase. Assuming that this process occurs in a maximally local way, when the PG-forming operator tucks-in below

---

[9]To capture certain facts about multi-PG contexts, Nissenbaum (2000) proposes that overlapping operators must form crossing paths, as I have stated to be the case in (32). If the movements in configurations like (32) really behave in this way, then we make an additional prediction, given the following prediction:

the relativizing one, the former will insert its corresponding λe above that previously formed by movement of the latter. The result is two stacked semantic argument positions, in reverse order relative to the phrases whose movement formed them:

(32)   *Movement of PG-forming operator in the relative clause*

$$
\begin{array}{c}
\text{CP} \\
\text{<e,<e,t>>} \\
(\lambda y.\lambda x.x \text{ weren't that flattering to y})
\end{array}
$$

$$
\text{OP}_{REL_1}
$$

$$
\text{OP}_{PG_2} \quad \text{C}'
$$

$$
\text{<e,<e,t>>}
$$

$$
\lambda_2 \quad \text{C}'
$$

$$
\text{<e,t>}
$$

$$
\lambda_1
$$

$$
\text{that } t_{REL_1} \text{ weren't that flattering to } t_{PG_2}
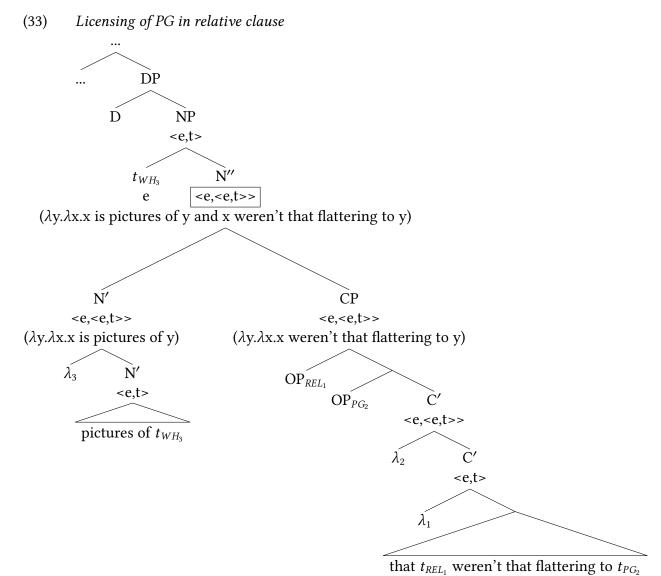$$

Importantly, this relative clause, as well as the N′ sister of the intermediate trace of movement through NP that we saw in (29b) above, are both type <e,<e,t>>. I assume that Predicate Modification is an instance of a more general mechanism that can semantically combine any two nodes of the same semantic type (see Partee and Rooth 1983; Nissenbaum 2000; Nissenbaum and Schwarz 2011). If this is so, then the PG-bearing relative clause can be interpreted upon merging to this N′, since both are type <e,<e,t>>.[10] The result of this merger is the boxed two-place predicate N″ shown below:

(i)   When multiple phrases form specifiers of vP upon successive cyclically A′-moving from it, a single PG in a sentential adjunct of that vP can only be licensed by the structurally highest moved phrase (a consequence of Nissenbaum (2000), for discussion see Fox and Nissenbaum 2018; Davis 2020b).

In isolation, relativizing and PG-forming operators can both license (additional) PGs. Given (i), if the movement of the PG-operator tucks-in beneath that of the relativizing operator (presumably in the vP phase and also in their final landing sites), then we expect a second PG in an additional island to only be successfully licensed by the relativizing movement. This is true, as we see in (ii), where a PG-hosting sentential adjunct is added to a PG-containing relative clause:

(ii)   Guess who$_1$ I painted [a silly portrait of t_1]$_2$ [that John likes to give copies of __$_2$ to friends of PG$_1$...
         ...[**in order to make them want to buy PG$_2$**]] / *...[**in order to introduce them to PG$_1$**]]

[10]I assume that adjunction of the relative clause applies after successive-cyclic movement within NP. See Zyman (To appear) for independent evidence that adjunction to a given phase follows the application of movement within it. See Stepanov (2001) for further arguments that adjuncts generally merge late.

(33) *Licensing of PG in relative clause*

...

... DP

D NP
   $\langle e,t \rangle$

t_{WH_3} N''
e $\boxed{\langle e,\langle e,t \rangle\rangle}$

($\lambda y.\lambda x.x$ is pictures of y and x weren't that flattering to y)

N'
$\langle e,\langle e,t \rangle\rangle$
($\lambda y.\lambda x.x$ is pictures of y)

CP
$\langle e,\langle e,t \rangle\rangle$
($\lambda y.\lambda x.x$ weren't that flattering to y)

λ_3 N'
$\langle e,t \rangle$

pictures of t_{WH_3}

OP_{REL_1}

OP_{PG_2} C'
$\langle e,\langle e,t \rangle\rangle$

λ_2 C'
$\langle e,t \rangle$

λ_1

that t_{REL_1} weren't that flattering to t_{PG_2}

(= Who$_1$ did Mary take **[pictures of t_1 [that weren't that flattering to PG$_1$]]**?)

The first semantic argument position of the boxed function is saturated by the trace of successive cyclic movement through NP. This yields a type $\langle e,t \rangle$ NP, denoting a set of entities that are pictures of, but not flattering to, the referent of the extracted phrase *who*. This NP is fit to undergo Functional Application with D/Q as usual, and the derivation will successfully converge on an interpretable result.[11]

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[11]In addition to the operator movement analysis of relative clauses assumed here, previous literature has also argued for at least two other analyses. One of these is the matching analysis, in which an NP syntactically identical to the head of the relative clause (though partially deleted at PF) moves within the relative clause. The other is the head-raising analysis, for which relativization is not achieved by movement of an operator or second NP within the relative clause, but rather by movement of the head itself. (See Bhatt (2015) for a recent overview.) Both the operator movement analysis and the matching analysis involve movement in the relative clause, which will become a semantic predicate as a result of such movement, and

In summary, a PG-bearing relative clause is a two-place predicate, whose interpretation depends on it merging to another two-place predicate. Since relative clauses adjoin to NPs, which are usually type <e,t>, successive-cyclic movement from NP creates a second two-place predicate within it that the PG-bearing relative clause can merge to.[12]

5.1 On the order of the gaps

All examples of PG-containing relative clauses shown so far have involved the gap of relativization preceding the PG. A further and potentially surprising fact is that reversing the gaps is not acceptable, as (34) shows. Here the intended PG is marked in the usual way, while the gap intended to correspond to relativization is underlined. These examples avoid

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then adjoin to the head NP. These analyses are straightforwardly compatible with what I have proposed here, only differing in how much syntactic material is posited to be contained in the element that moves to form the relative clause. The head raising analysis involves some additional complications, however.

In particular, the influential version of the raising analysis in Kayne (1994) (recently pursued further in Sichel (2018)) involves movement of the relative head to the edge of a CP, which is then selected by D (i):

(i)   This is [$_{DP}$ the [$_{CP}$ book$_1$ [$_{C'}$ that I read t_1]]].

Here the nominal phrase that "heads" the relative clause is not modified by CP, but rather a C′, given that C is assumed to project under this analysis. Importantly, this analysis presents a challenge to what I have proposed here. Recall that, as shown in (39) above, the semantic composition of PGs in relative clauses involves successive-cyclic movement to pass through the edge of the constituent that is selected by D. In (39), this constituent is NP, as usual. However, under the raising analysis, the label of the constituent that is the sister of D in (39) would be CP, not NP. Thus this configuration would actually have to involve successive-cyclic movement via the edge of CP, contrary to my proposal about movement via the NP edge.

An issue with this version of the head-raising analysis is that it must allow D to exceptionally select a CP as its complement. Additionally, the CP selected by D in such contexts would have to have the semantics of an NP, since otherwise it is unclear how semantic composition with D can succeed. These issues dissolve if we adopt a version of the head-raising analysis under which D selects an NP, as usual. Precisely such an analysis is proposed by Cecchetto and Donati (2015), who argue that when the nominal head of the relative clause raises and lands in the edge of the relative CP, the relative clause inherits the category of the head, and is thus re-labeled as NP. This NP can be straightforwardly selected by D and interpreted with no additional assumptions, and movement through the edge of this NP will achieve the licensing of a PG in the relative clause in precisely the same way as I have argued above.

For another variant of the head raising analysis that is compatible with this paper's proposals, see Henderson (2007), who accomplishes head raising via sideward movement in such a way that culminates in merger of the relative clause to an NP, just as in other analyses of relativization.

[12]Nissenbaum (2000) proposes that a moved phrase and the corresponding λe created by Predicate Abstraction can sometimes be somewhat non-local. If this is so, it is conceivable that the PG facts investigated here actually involve movement via spec-DP, but that non-local Predicate Abstraction applies to the NP dominated by the DP that movement passes through. In this case, the NP would still be type <e,<e,t>> as described above, and could combine with a PG-bearing relative clause. However, if there is no trace of movement in the NP edge, then NP will combine with D before combining with the intermediate trace, causing a type mismatch: Since a type <e,<e,t>> NP cannot combine with a D that outputs an individual (<<e,t>,e>) or with a quantificational determiner (<<e,t>,<<e,t>,t>>), this derivation will fail. In contrast, successive-cyclic movement via the edge of NP results in immediate saturation of the <e,<e,t>> position in NP created by Predicate Abstraction, yielding a type <e,t> NP fit to combine with D as usual, as we've seen.

placing any of the gaps in subject position, in order to rule out any potential confounds stemming from locality considerations unique to subject extraction.

(34)   *Reltivization gap must precede PG*

a.   Who$_1$ did you paint [a silly portrait of t_1]$_2$ [that John likes to give copies of __$_2$ to friends of PG$_1$]?

b.   *?? Who$_1$ did you paint [a silly portrait of t_1]$_2$ [that John likes to send friends of PG$_1$ copies of __$_2$]?

c.   Let me tell you [which animal]$_1$ I made [a statue of t_1]$_2$ [that I intend to send __$_2$ to a fan of PG$_1$].

d.   *?? Let me tell you [which animal]$_1$ I made [a statue of t_1]$_2$ [that I intend to send a fan of PG$_1$ an exact copy of __$_2$].

Notice that in the sentences in (34), we do not in fact know at first glance which is the gap of relativization and which is the PG. It would be descriptively adequate to state that in these sentences the head of the relative clause always co-refers with the first gap, and the phrase extracted from NP with the second gap. I will propose that this is in fact a natural result, given the derivation outlined above.

First, assume that Predicate Abstraction in NP triggered by successive cyclic extraction from it will always form the outer λe of the resulting type <e,<e,t>> N′, as we see in (29b) above. Second, assume that in the PG-hosting relative clause, the higher of the two operators moves first, and the second tucks-in below it. As described above, if Predicate Abstraction applies in a strictly cyclic and local way in multiple movement contexts, the operator that moves second and tucks-in will trigger insertion of a corresponding λe above that formed by the prior movement of the other operator. The result is two stacked semantic argument positions, in reverse order relative to the operators whose movement formed them, as we saw in (32) above. Abstracting away from the origination positions of the relevant operators, notice that given this second assumption, the outer λe of the type <e,<e,t>> relative clause will always correspond to the inner of the two moved operators, which in turn always corresponds to the second gap in the relative clause.

Predicate Modification unites the outer λe of the <e,<e,t>> PG-containing relative clause with the outer λe of the <e,<e,t>> N′ that the relative clause merges to, as we saw in (33) above, yielding yet another <e,<e,t>> constituent. The first λe of that resulting function will be saturated by the trace of the phrase that A′-moves from NP. Consequently, the extracted phrase will always bind both its actual trace in NP, as well as whatever the second gap in the relative clause happens to be. As we saw in (34) above, this is precisely the pattern of judgments we find in reality.

This concludes the core analysis of PGs in relative clauses. The main point here is that properly deriving the interpretation of such PGs requires the hypothesis that the movement of the PG-licensing phrase from the relativized NP must involve a step of successive-cyclic movement through the NP edge—something which is independently predicted by works arguing that the NP is a phase. In the remainder of this paper, I relate this analysis

to several other extensions and consequences.[13] [14]

6 An asymmetry with stacked relative clauses

In this section, I discuss an asymmetry that arises when multiple relative clauses are stacked in one NP, which is analogous to an independent finding from Nissenbaum (2000). Nissenbaum observed that when one CP hosts two sentential adjuncts, both can have a

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[13]For at least some speakers, PG-containing relative clauses can extrapose (i):

(i) a. Who$_1$ did Mary take [pictures of t_1 t_2] yesterday [that weren't that flattering to PG$_1$]$_2$?
     b. Let me tell you who$_3$ I've noticed [an aspect of t_3 t_4], just now, [that really makes me want to avoid PG$_3$]$_4$.

If these PGs depend on the relative clause being interpreted as adjoined to an NP that has been passed through by successive cyclic A$'$-movement, then this fact may serve as evidence for the theory of adjunct extraposition as late merge after covert movement of the "source" phrase (Fox and Nissenbaum 1999; Nissenbaum 2000; Fox 2002; Johnson 2012; Overfelt 2015a). Under such an analysis, in (i) the relevant DP covertly moves, and the head of the covert movement chain is targeted by external merge of the relative clause. For this analysis the relative clause is thus interpreted in precisely the same way as usual, though the nominal structure it is merged to happens to be covert

Karlos Arregi (personal communication) asks whether PG-containing relative clauses might always extrapose, though this would have to be string vacuous in most examples reported in this paper. Fox (2002) suggests that string vacuous extraposition is ruled out by parsing considerations. That string-vacuous extraposition is not available is suggested by patterns like (ii) below. Here we see that extraposition can ameliorate potential principle C violation for an R-expression contained in the relative clause, though the same is not possible if the relative clause does not extrapose. If string-vacuous extraposition were an option, there should be no difference between these examples:

(ii) (Fox and Nissenbaum 1999, ex. 11)
      a. I gave him$_1$ a picture yesterday [**from John's$_1$ collection**].
      b. ??/* I gave him$_1$ a picture [**from John's$_1$ collection**] yesterday.
      c. I gave him$_1$ an argument yesterday [**that supports John's$_1$ theory**].
      d. ??/* I gave him$_1$ an argument [**that supports John's$_1$ theory**] yesterday.
      e. I told you that he$_1$ will accept the argument, when you and I last spoke, [**that I presented to John$_1$**] yesterday.
      f. ??/* I told you when you and I last spoke that he$_1$ will accept the argument [**that I presented to John$_1$**] yesterday.

Tentatively, I report that a principle C violation arises as expected for a PG-containing relative clause:

(iii) ??*Who$_1$ did she$_2$ paint a picture of t_1 [that Mary$_2$ thought wasn't very flattering to PG$_1$]?

If the covert movement plus late merge theory of extraposition is right, then the possibility of (at least non-vacuous) extraposition does not affect the arguments of this paper in any significant way.

[14]To whatever extent these findings support the presence of a nominal internal phase, they also converge with an intuition expressed by previous literature that there is a structural analogy between clauses and nominals (Abney 1987; Szabolsci 1994; Syed and Simpson 2017), particularly if vP is taken to be a phase.

PG (35), but when only one of the adjuncts has a PG, it must be the inner of the two (36):[15]

(35) *Multiple sentential adjuncts*

    a.   *Both without a PG*
        Guess [which computer]$_1$ we'll try to buy t_1 [without even reading reviews about **it**] [after getting funding from the department for **it**].

    b.   *Both with a PG*
        Guess [which computer]$_1$ we'll try to buy t_1 [without even reading reviews about **PG**$_1$] [after getting funding from the department for **PG**$_1$].

(36) *Only the inner of two adjuncts can be the lone PG-bearer*

    a.   Guess [which computer]$_1$ I'll try to buy t_1 [without even reading reviews about **PG**$_1$] [after I get my next paycheck].

    b.   *?? Guess [which computer]$_1$ I'll try to buy t_1 [after I get my next paycheck] [without even reading reviews about **PG**$_1$].

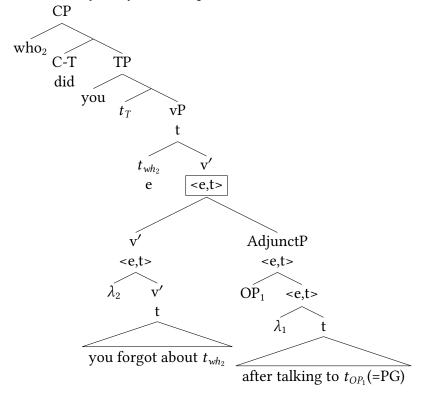I report that the same asymmetry holds for an NP with stacked relative clauses:

(37) *PGs in stacked relative clauses*

    a.   Guess [which actor]$_8$ I took pictures of t_8 [that weren't very flattering to **PG**$_8$] [that unfortunately really embarrassed **PG**$_8$].

    b.   Guess [which actor]$_8$ I took pictures of t_8 [that weren't very flattering to **PG**$_8$] [that unfortunately turned out blurry].

    c.   *?? Guess [which actor]$_8$ I took pictures of t_8 [that unfortunately turned out blurry] [that weren't very flattering to **PG**$_8$].

Here I will summarize Nissenbaum's account of the contrast between (35-36), and show how it naturally extends to the relative clause fact in (37). Abels and Bentzen (2009), in a critical consideration of evidence for successive-cyclicity, argue that Nissenbaum asymmetry qualifies as useful evidence for the successive-cyclicity of movement from vP. If this is so, then the arising of a similar PG asymmetry in contexts with stacked relative clauses supports the proposal that PGs in relative clauses constitute evidence for successive-cyclic movement from NP.

    Recall that for Nissenbaum, PGs in sentential adjuncts are licensed by successive cyclic A′-movement through the edge of vP. This triggers Predicate Abstraction, which creates an <e,t> position in the vP to which a PG-bearing adjunct can be merged:
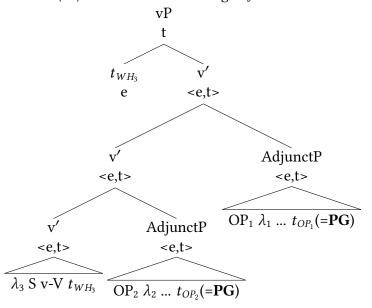
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[15]Though the original observation is Nissenbaum's, the examples in (35-36) are mine. Nissenbaum's original examples alternate between using a PG versus a co-indexed pronoun to illustrate the contrast, but the judgment here is clearer if we include no such pronoun in the gap-less adjuncts.

(38)   *Successive-cyclicity creates a position in vP where a PG can be interpreted*

```
                CP
        who₂
              C-T        TP
              did
                   you
                        t_T        vP
                                    t
                              t_wh₂        v′
                                e        <e,t>
                         v′                      AdjunctP
                        <e,t>                      <e,t>
                    λ₂      v′              OP₁      <e,t>
                            t                    λ₁      t
                  you forgot about t_wh₂
                                         after talking to t_OP₁(=PG)
```

Nissenbaum points out that we expect it to be possible to simply merge additional PG-bearing sentential adjuncts one after the other: since these adjuncts combine with the vP by Predicate Modification, in principle, any number of them could be included in the same way, as the truncated diagram in (39) shows:
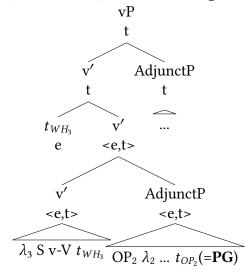
(39)   *Two PG containing adjuncts in one vP*

```
                  vP
                  t
         t_WH₃              v′
           e              <e,t>
               v′                      AdjunctP
              <e,t>                      <e,t>
        v′            AdjunctP    OP₁ λ₁ ... t_OP₁(=PG)
       <e,t>           <e,t>
   λ₃ S v-V t_WH₃   OP₂ λ₂ ... t_OP₂(=PG)
```

20

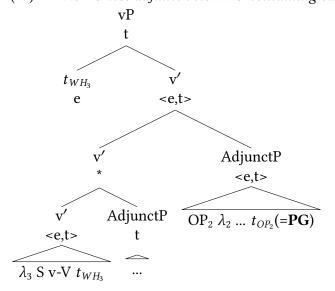We saw in example (35b) above that this is indeed the case in reality.

While a sentential adjunct containing a PG is type <e,t> as we've seen, a sentential adjunct that lacks a PG will simply be type t. Since such an adjunct cannot combine with the <e,t> node formed by successive cyclic movement from vP, it must adjoin above the landing site of that movement. Thus if one adjunct contains a PG, but another does not, the latter will end up outermost if the two co-occur:

(40)　　*Lower adjunct with PG, higher adjunct without*

For the same reason, it not possible for the PG-less adjunct to merge beneath the PG-containing one. Since this region of the vP is a predicate (type <e,t>) due to the effect of Predicate Abstraction, merger of a PG-less adjunct here will result in a type mismatch:
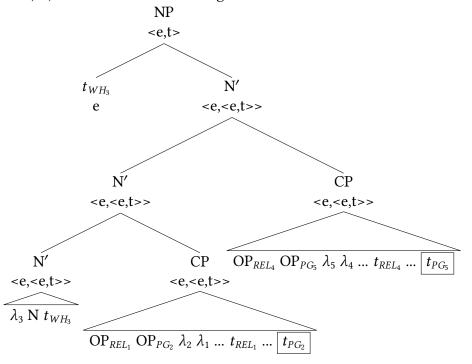
(41)　　*No PG-less adjunct below PG-containing one*

21

We saw in (36) above that this is the correct pattern of facts in reality.[16]

The same form of argumentation, but involving higher semantic types, captures the relative clause facts in (37) above. If an NP exited by successive-cyclic extraction contains a node of type $\langle e, \langle e, t \rangle \rangle$ as argued above, any number of PG-containing relative clauses can combine with this position via generalized Predicate Modification:
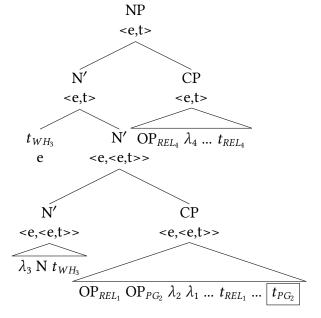
(42) *Stacked PG-containing relative clauses*

NP
$\langle e,t \rangle$

t_{WH_3}
e

N′
$\langle e, \langle e, t \rangle \rangle$

N′
$\langle e, \langle e, t \rangle \rangle$

CP
$\langle e, \langle e, t \rangle \rangle$

N′
$\langle e, \langle e, t \rangle \rangle$

λ_3 N t_{WH_3}

CP
$\langle e, \langle e, t \rangle \rangle$

OP_{REL_1} OP_{PG_2} λ_2 λ_1 ... t_{REL_1} ... $\boxed{t_{PG_2}}$

OP_{REL_4} OP_{PG_5} λ_5 λ_4 ... t_{REL_4} ... $\boxed{t_{PG_5}}$

Further, nothing prevent adjoining a PG-containing relative clause below the landing site of extraction from NP, and a PG-less relative clause above it, yielding the pattern in (37b):
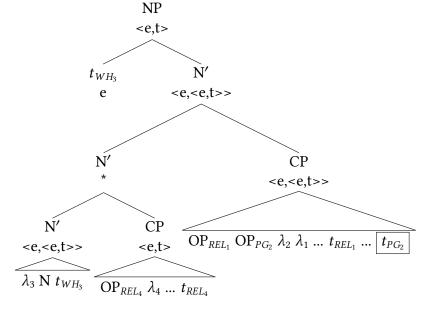
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[16]It is worth asking why it is not possible to successfully create the illicit configuration in (41) by merging the PG-less constituent even lower, to a segment of vP that is below the region affected by Predicate Abstraction. If as Nissenbaum (2000) suggests Predicate Abstraction is not a mechanism that introduces a distinct abstraction into the syntactic tree (contra Heim and Kratzer 1998) but rather essentially a type-shifting operation, then there is not necessarily a distinct syntactic position where lower merger of the sort just described could actually successfully occur. Alternatively, if adjuncts generally merge late, then it may be the case that more deeply merging the PG-containing adjunct in order to create a configuration like (41) is illicit due to a ban on late merging deeply within the structure built so far. Such a constraint is indeed proposed by many works who examine late merge (Tada 1993; Sauerland 1998; Stepanov 2001; Stanton 2016; Safir 2018). These general considerations about potential merge positions for PG-hosting phrases apply not only to stacked sentential adjuncts, but also to stacked relative clauses, which as we've seen display the same fundamental PG asymmetry.

(43) *PG-containing relative clause below PG-less one*

NP
<e,t>

 N′   CP
 <e,t>   <e,t>

 t_{WH_3} N′ OP_{REL_4} λ_4 ... t_{REL_4}
 e   <e,<e,t>>

   N′   CP
   <e,<e,t>>   <e,<e,t>>

   λ_3 N t_{WH_3}

    OP_{REL_1} OP_{PG_2} λ_2 λ_1 ... t_{REL_1} ... $\boxed{t_{PG_2}}$

In contrast, a PG-less relative clause cannot adjoin beneath a PG-containing one, as example (37c) above showed. A PG-containing relative clause is type <e,<e,t>> and thus must be merged below the trace of extraction from NP. However, a PG-less relative clause of type <e,t> will yield a type mismatch if merged into this region of the NP:

(44) *No PG-less relative clause below PG-containing one*

NP
<e,t>

 t_{WH_3} N′
 e   <e,<e,t>>

   N′   CP
   *   <e,<e,t>>

   N′   CP
   <e,<e,t>>   <e,t>

   λ_3 N t_{WH_3} OP_{REL_4} λ_4 ... t_{REL_4}

    OP_{REL_1} OP_{PG_2} λ_2 λ_1 ... t_{REL_1} ... $\boxed{t_{PG_2}}$

  In sum, if PGs in both sentential adjuncts and relative clauses are licensed when local to a particular node in vP/NP created by successive-cyclic movement, then we can account for the judgment patterns about stacked PG-containing constituents discussed here.

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7 Binding evidence for successive-cyclic movement from NP

Here I discuss additional evidence for the possibility movement via the NP edge from an interaction between variable binding and principle C. This test has been discussed previously as a diagnostic for successive cyclicity by at least Lebeaux (1992) and Sauerland (1998). An instance of this interaction consistent with the possibility of movement via the CP edge is provided in (45) below. Here a relative clause of a *wh*-moved phrase contains a pronoun *he* co-indexed with the quantifier phrase *every student*, as well as an R-expression *Mary* co-referent with the pronoun *she*.

(45)   *Successive cyclicity and variable binding versus principle C*

    a.   * [Which paper that he_1 gave to $Mary_2$]$_3$ did she_2 think [$_{CP}$ t_3 that [every student]$_1$ would like $\boxed{t_3}$]?

    b.   [Which paper that he_1 gave to $Mary_2$]$_3$ did [every student]$_1$ think [$_{CP}$ $\boxed{t_3}$ that she_2 would like t_3]?
       (Adapted from Sauerland 1998, ex. 31)

A quantifier phrase must c-command the position in which a co-referent pronoun is interpreted. In contrast, an R-expression must not be interpreted in a position c-commanded by a co-referent element, or else a principle C violation will arise. Given these requirements, in (45a), variable binding must be satisfied by reconstruction of the *wh*-phrase to its base position, which is the only position in the derivation it has occupied that is c-commanded by the quantifier phrase *every boy*. Since this position is also c-commanded by the pronoun *she* co-referent with the R-expression *Mary* in the relative clause, there is an irreconcilable conflict between the needs of variable binding and principle C, resulting in unacceptability. In contrast, in (45b), the positions of *every student* and *she* are reversed. In this context, an acceptable result can be achieved by reconstructing the *wh*-phrase to its intermediate landing site in the edge of the embedded CP. In this position, the pronoun *he* in the relative clause is appropriately c-commanded by *every student*, and the R-expression *Mary* is not c-commanded by the co-referent pronoun *she*, which is lower in the embedded clause. The fact that reconstruction to this position is possible is consistent with the hypothesis that A′-movement from CP passes through its edge.

    We can manipulate the configuration in (45) in order to provide evidence consistent with the possibility of movement via the NP edge, as in (46) below. Here we see *wh*-movement from a recursive DP structure in which both DPs are possessed. The moved *wh*-phrase contains a relative clause whose content is the same, in the relevant ways, as that in (45) above. While extraction from possessed DPs is widely known to be degraded in English, there is nevertheless a clear contrast between the two examples in (46):

(46)   *Variable binding versus principle C in the NP*

    a.   * [Which picture that $Mary_2$ sent him_1]$_3$ did you witness [$_{DP1}$ her_2 [$_{NP}$ denial of [$_{DP2}$ every boy_1's claims about $\boxed{t_3}$]]]?

    b.   ? [Which picture that Mary$_2$ sent him$_1$]$_3$ did you witness [$_{DP1}$ every boy$_1$'s [$_{NP}$ $\boxed{t_3}$ denial of [$_{DP2}$ her$_2$ claims about t_3]]]?

In (46a), the *wh*-phrase containing this relative clause must reconstruct to its base position in DP2, whose possessor is *every boy*, for the purposes of variable binding. However, this position is c-commanded by DP1's possessor *her* which is co-referent with the R-expression *Mary* in the relative clause. This conflict makes (46a) unacceptable. In contrast, in the modified configuration in (46b), the positions of *her* and *every boy* are reversed. In this context, it is possible to both satisfy variable binding and avoid a principle C violation by reconstructing to a position between above the possessor of DP2, but below the possessor of DP1. Such a position is consistent with the edge of the NP *denial*, as marked by the trace in (46b).[17]

8 Implications for the analysis of extraction from NP

In this section, I discuss some general considerations about the nature of extraction from nominal phrases. A few works have claimed that extraction from NP/DP is not in fact possible, and that when it appears to happen, some form of re-analysis or base generation is occurring (Bosque and Gallego 2014; Reeve 2018). The possibility of PG-licensing in relative clauses by extraction from NP indicates that this view is incorrect. Given the well-established fact that the constituent containing a PG must be crossed by the licensing movement chain (Engdahl 1983; Nissenbaum 2000; Culicover and Postal 2001), it is unclear how PGs in relative clauses are possible if movement from NP/DP is illusory.

More significant are the implications of this analysis for theories about the locality of extraction from NPs. Bošković (2005, 2016), extending insights from previous research (Uriagereka 1988; Corver 1990, 1992), argues that the presence of D constrains extraction from NP. Bošković focuses on left branch extraction (Ross 1967, a.o.) of elements originating in the edge of NP, such as adjectives. This variety of extraction is possible in many but not all languages. English is among the languages that ban left branch extraction, but many Slavic languages like Serbo-Croatian permit it, for instance:

(47)   *Not all languages permit left branch extraction* (Bošković 2016, ex. 16-17)

    a.   **Skupa**$_1$ on voli   [$_{NP}$ t_1 kola].
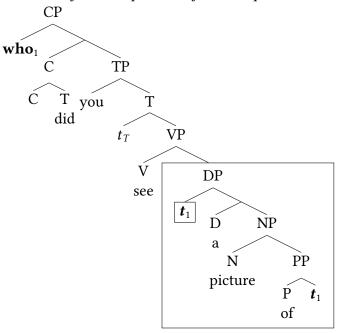   expensive he loves   cars
        (Serbo-Croatian)

---

[17]A confound about (46b) worth nothing here is that the binding requirements in question would also be satisfied by reconstruction to the specifier of the PP *of* in the complement of *denial*. I am aware of no independent evidence for the possibility of movement through spec-PP in English, however. Following Abels (2003), locality considerations may independently rule out such movement, though see Abels (2012) for a contrasting view.

An analogous criticism can be made of (45b) above: this example is also predicted to be acceptable under reconstruction to a low position in the matrix clause c-commanded by *every student*, such as the specifier of VP or vP. This diagnostic is thus unfortunately not particularly fine-grained.

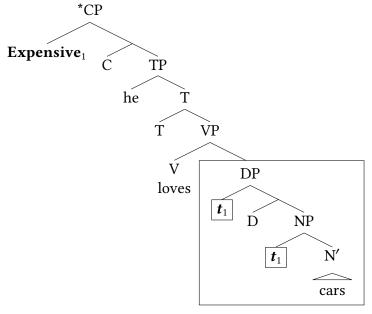b. * **Expensive**$_1$ he loves [$_{DP}$ ∅$_D$ t_1 cars].
(English)

Bošković's proposal about this cross-linguistic point of variation is as follows. DP is a phase, thus movement from DP must pass through spec-DP. Movement from the complement of NP to spec-DP, and then onward, is licit, as in a structure like (48):
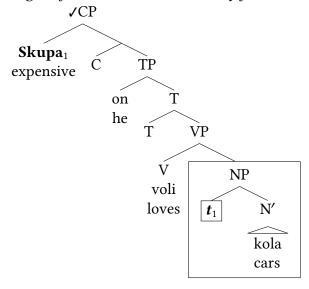
(48) *Extraction from complement of NP via spec-DP*

In contrast, for his proposal, movement from a non-complement position in NP to spec-DP is illicit due to being too short, given a certain definition of *anti-locality* (Bošković, 1997; Ishii, 1999; Grohmann, 2003; Abels, 2003; Erlewine, 2016, a.o.). Specifically, what is needed here is an anti-locality constraint that bans movement from the specifier of a given phrase XP when that movement does not cross a maximal projection other than XP. Given such a constraint, left branch extraction of an adjective, for instance, would require an illegally short step of movement from the NP edge to the edge of the DP phase in a language like English (49):

(49) *Anti-local extraction from adjunct/specifier of NP through spec-DP*

```
                    *CP
              ┌──────┴──────┐
      Expensive₁      ┌──────┴──────┐
                      C            TP
                             ┌──────┴──────┐
                            he            T
                                    ┌──────┴──────┐
                                    T            VP
                                          ┌───────┴───────┐
                                          V          ┌────DP────┐
                                        loves       t₁    ┌────┴────┐
                                                          D        NP
                                                            ┌───────┴───────┐
                                                           t₁             N′
                                                                          ╱╲
                                                                         cars
```

Further, Bošković argues that in languages like Serbo-Croatian there is no D projection. Hence nothing blocks left branch extraction, which succeeds in such languages (50):

(50) *Legal left branch extraction directly from NP edge in Serbo-Croatian*

```
                   ✓CP
              ┌──────┴──────┐
        Skupa₁        ┌──────┴──────┐
       expensive      C            TP
                             ┌──────┴──────┐
                            on            T
                            he      ┌──────┴──────┐
                                    T            VP
                                          ┌───────┴───────┐
                                          V        ┌────NP────┐
                                        voli      t₁         N′
                                        loves                ╱╲
                                                            kola
                                                            cars
```

With this theory in mind, recall my argument that at least when a PG in a relative clause is involved, English must permit successive-cyclic movement via the NP edge. If my arguments are correct, Bošković's account of the ban on left branch extraction in languages like English is inaccurate in some way. Either the relevant version of anti-locality is incorrect[18] and thus movement from the NP edge to the DP edge is permitted,

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[18]The needed concept of anti-locality could be correct but inapplicable to this context, if the nominal

or DP is not a phase, at least in English (Sabbagh 2007; Chomsky et al. 2019; Davis 2019; Zyman To appear), and thus movement via spec-DP is unnecessary.

Either way, Bošković's proposal cannot be maintained, if the arguments of this paper are correct. Bošković's proposal may in any case be an over-generalization: see, for instance, Fanselow and Féry (2013) and Pankau (2019) for discussion of some potential counterexamples to it. Yet another possibility is that DPs are phases, and the relevant notion of anti-locality is correct, but left branch extraction is not straightforward extraction in the way Bošković argues. Left branch extraction has also been argued to involve remnant movement (Franks and Progovac 1994; Starke 2001; Kayne 2002; Bašic 2008, 2009; Abels 2003, 2012, a.o.) or distributed deletion at PF (Faneslow and Ćavar 2002; Bošković 2001, 2015; Fanselow and Féry 2013; Bondarenko and Davis 2019, a.o.), at least in some languages. If left branch extraction is in general not actual extraction, the locality considerations discussed in Bošković's proposal would not be applicable.

8.1 DP-internal adjective movement and anti-locality

There is additional evidence suggest that, at least in English, movement from the edge of NP to the edge of DP is permitted. As observed by Bresnan (1973), English displays what might be characterized as DP-internal adjective fronting, which Adger (2003) and Zompì (2020) suggest involves movement to spec-DP:

(51)   *DP-internal adjective fronting*

    a. $[_{DP}$ [**how fierce**$]_1$ a $[_{NP}$ t_1 battle]]
            (Adapted from Adger 2003, ex. 87)

    b.   He's $[_{DP}$ [**that reliable**$]_1$ a $[_{NP}$ t_1 man]].
            (Adapted from Bresnan 1973, ex. 111a)

    c.   He was $[_{DP}$ [**as humble**$]_1$ a $[_{NP}$ t_1 man as his father]].
            (Zompì 2020, ex. 81a)

There are some reasonable worries one might have about this construction: for instance, it appears to be possible only for the combination of the determiner *a(n)* with an adjective modified by a degree. Nevertheless, if this configuration truly involves movement, this would be movement from the NP edge to the DP edge. If DP is a phase, the possibility of PGs in relative clauses licensed by extraction from NP necessitates the additional conclusion that such movement is possible.

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domain in fact contains additional projections between NP and DP, as Syed and Simpson (2017) note. This consideration makes salient a weakness of theories relying on anti-locality: any apparent violation of anti-locality can be accommodated by proposing additional structure, but such proposals are difficult to falsify, since the absence of null structure is not easy to prove.

Another possibility is that the needed conception of anti-locality is correct, but that anti-locality is violable, as Erlewine (2016) proposes.

9 Conclusion

Here I have argued that the licensing of PGs in relative clauses by extraction from NP reveals the possibility of successive-cyclic movement via the NP edge.

(52)   *PG in relative clause licensed by movement through NP edge*
$$[\ WH_4 \ S \ V \ [_{DP} \ D \ [_{NP} \ \boxed{t_4} \ [_{N''} \ [_{N'} \ N \ t_4 \ ] \ [_{RC} \ ... \ PG_4 \ ]]]]]$$

Such movement is expected by research arguing for the phasehood of a constituent like NP, though I reiterate that the facts in focus here demonstrate merely the possibility, not the necessity, of such movement. I argue that the possibility of such movement is supported by several lines of evidence, and has significant implications for theories about the interaction of locality and extraction from NP.

Devising a way of diagnosing whether movement via the NP edge is obligatory or not is a task that I will leave to future work. Furthermore, I have not yet come across a language other than English where the PG construction I examine here is attested. I leave the search for such a language to future work as well.

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